

Geologic Resource Evaluation Scoping Summary Fort Bowie National Historic Site, Arizona

Geologic Resources Division
National Park Service
US Department of the Interior



The Geologic Resource Evaluation (GRE) Program provides each of 270 identified natural area National Park Service units with a geologic scoping meeting, a digital geologic map, and a geologic resource evaluation report. Geologic scoping meetings generate an evaluation of the adequacy of existing geologic maps for resource management, provide an opportunity for discussion of park-specific geologic management issues and, if possible, include a site visit with local experts. The purpose of these meetings is to identify geologic mapping coverage and needs, distinctive geologic processes and features, resource management issues, and potential monitoring and research needs. Outcomes of this scoping process are a scoping summary (this report), a digital geologic map, and a geologic resource evaluation report.

The National Park Service held a GRE scoping meeting for Fort Bowie National Historic Site (FOBO) on April 5, 2006, at the Chiricahua National Monument headquarters. Stephanie O'Meara (CSU) facilitated the discussion of map coverage and Sid Covington (NPS GRD) led the discussion regarding geologic processes and features at the historic site. Participants at the meeting included NPS staff from the park, Geologic Resources Division, and NPS Intermountain Region and cooperators from the United States Geological Survey (USGS), Arizona Geological Survey (AZGS), and Colorado State University (CSU) (see table 2). This scoping summary highlights the GRE scoping meeting for Fort Bowie National Historic Site including the geologic setting, the plan for providing a digital geologic map, a prioritized list of geologic resource management issues, a description of significant geologic features and processes, lists of recommendations and action items, and a record of meeting participants.

Park and Geologic Setting

Fort Bowie, established as a National Historic Site on July 29, 1972, encompasses 999.45 acres in extreme southeastern Arizona. The fort was established in 1862 to guard Apache Pass, a natural passage between the Dos Cabezas and Chiricahua Mountains connecting San Simon and Sulphur Springs Valleys. It was the focal point of military operations against Geronimo and his band of Apaches. Fort Bowie also preserves part of the Butterfield Overland Mail route.

Geologic conditions directly influenced the choice of the site. The dependable springs, including Apache Spring, that have attracted humans to this narrow passage for thousands of years are the result of the Apache Pass fault. The Apache Pass fault zone is the major geologic feature in the area and can be traced across the mountains for nearly 38 miles (60 km) (Bezy, 2001). The northwest-trending fault originally formed during Precambrian time but was reactivated in later geologic time.

Geologic Mapping for Fort Bowie National Historic Site

During the scoping meeting Stephanie O'Meara (CSU) showed some of the main features of the GRE Programs digital geologic maps, which reproduce all aspects of paper maps, including notes, legend, and cross sections, with the added benefit of GIS compatibility. The NPS GRE Geology-

GIS Geodatabase Data Model incorporates the standards of digital map creation set for the GRE Program. Staff members digitize maps or convert digital data to the GRE digital geologic map model using ESRI ArcMap software. Final digital geologic map products include data in geodatabase, shapefile, and coverage format, layer files, FGDC-compliant metadata, and a Windows HelpFile that captures ancillary map data.

When possible, the GRE program provides large scale (1:24,000) digital geologic map coverage for each park's area of interest, which is often composed of the 7.5-minute quadrangles that contain park lands (figure 1). Maps of this scale (and larger) are useful to resource management because they capture most geologic features of interest and are positionally accurate within 40 feet. The process of selecting maps for management use begins with the identification of existing geologic maps and mapping needs in vicinity of the park. Scoping session participants then select appropriate source maps for the digital geologic data to be derived by GRE staff.

Map coverage for Fort Bowie consists of 2 quadrangles of interest mapped at a 1:24,000 scale (figure 1): Bowie Mountain North (GMAP 3074) and Bowie Mountain South (GMAP 3073). These quadrangles are located on the Wilcox 30' x 60' sheet. Table 1 lists the source maps chosen for Fort Bowie NHS.

Table 1. GRE Mapping Plan for Fort Bowie National Historic Site

Covered Quadrangles	GMAP ¹	Citation	Scale	Format	Assessment	GRE Action
Bowie Mountain South	3073	Drewes, Harald, 1981, Geologic map and sections of the Bowie Mountain South quadrangle, Cochise County, Arizona, US Geological Survey, I-1363, 1:24000 scale.	1: 24,000	paper	Structural issues with map. Contacts may be located correctly but may not be correctly identified.	Conversion of digital data to geodatabase data model; will integrate into either FY06 or FY07 projects.
Bowie Mountain North	3074	Drewes, Harald, 1984, Geologic map and sections of the Bowie Mountain North quadrangle, Cochise County, Arizona, US Geological Survey, I-1492, 1:24000 scale.	1: 24,000	paper	Structural issues with map. Contacts may be located correctly but may not be correctly identified	Conversion of digital data to geodatabase data model; will integrate into either FY06 or FY07 projects.

¹GMAP numbers are unique identification codes used in the GRE database.

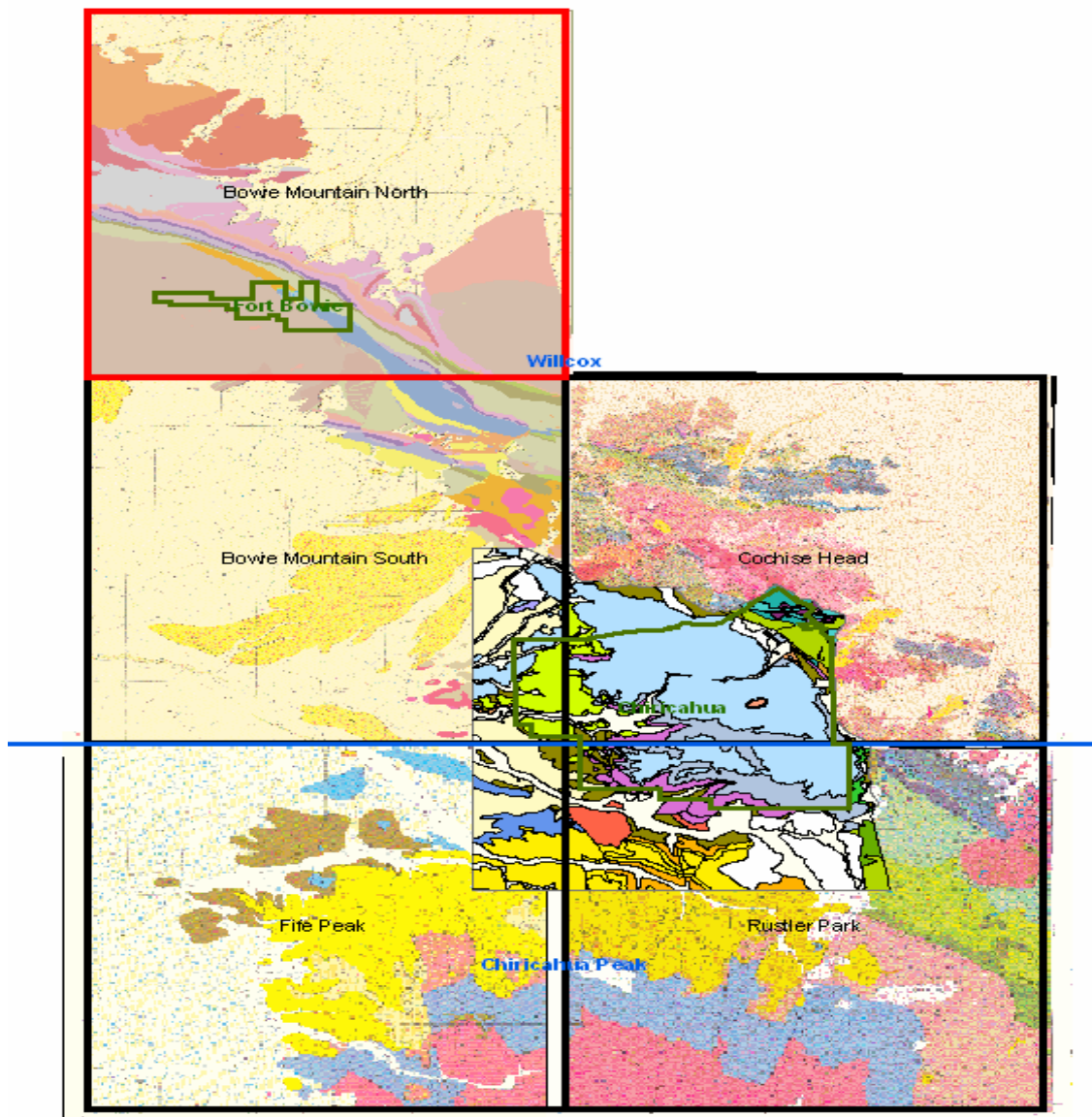


Figure 1. Area of interest for Fort Bowie National Historic Site and Chiricahua National Monument. The 7.5-minute quadrangles are labeled in black; red outlines indicate monument boundaries.

GRE staff have digitized both maps in table 1. According to Todd Shipman (AZGS) there are some structural issues on Drewes' maps that were used by the GRE to produce digital data of the park (GMAP 3073 and GMAP 3074). Contacts on Drewes' map are correctly placed but may not be correctly identified. For example, thrust contacts might be lithologic contacts (Ed du Bray, USGS). The unit descriptions, however, are good (Ed du Bray). Drewes' maps would be difficult to edge match. The park boundaries have changed since GMAP 3074 was published, also (Alan Whalon, NPS CHIR-FOBO).

There might only be 2 square miles (5 sq km) needing more work (Ed du Bray). Currently, legislation is being considered to expand Fort Bowie NHS and add 590 acres of BLM land in sections 1-3 and 10-12 of T15S, R28E (Alan Whalon, NPS CHIR-FOBO superintendent). It was proposed at the scoping meeting that an eight square mile area (sections 1-3 and 10-12 of T. 15 S., R. 28 E., and sections 6-7 of T. 15 S., R. 29 E.) be remapped to provide more accurate geologic mapping for the park. This area would cover in extent all of Fort Bowie NHS, as well as known planned expansions of the park, and would provide a limited buffer about the park, especially to the east where the park is in close proximity to section boundaries. In addition to remapping faults and revising the interpretation of the type of faulting, surficial units could possibly be mapped with greater detail. Todd Shipman suggested that mapping would require perhaps a few days to a week of fieldwork. A deliverable format to the GRE, i.e., field maps, digital data, was not discussed. The likely agency to conduct this remapping is the AZGS (Steve Richards, Charles Ferguson and/or Jon Spencer).

GRE mapping action planned for FY 2006 or FY 2007 includes:

- The GRE will evaluate a scoping proposal to re-map Fort Bowie NHS and the immediate area adjacent to the park as discussed above.
- The GRE will convert existing GRE digital data for the Bowie Mountain North quadrangle (GMAP 3074) and Bowie Mountain South quadrangle (GMAP 3073) from the GRE coverage and shapefile data model format to the GRE geodatabase data model format. This is required as integration of newly produced digital data may need to be in the same GIS format for edge-matching and compilation, and because the geodatabase format is now the standard GRE supported deliverable format. Digital data for the two quadrangles, although produced from problematic source maps, could still be used for areas beyond the extent of the proposed re-mapping for Fort Bowie NHS.

Geologic Resource Management Issues

The scoping session for Fort Bowie National Historic Site provided the opportunity to develop a list of geologic features and processes, which will be further explained in the final GRE report. During the meeting, Colleen Filippone (NPS Intermountain Region) prioritized the most significant issues as follows:

- (1) Erosion issues, and
- (2) Map issues as previously discussed

Erosion Issues

Erosion processes that impact the Apache Spring watershed are the most significant issues facing Fort Bowie management (Colleen Filippone). Some of these issues are due to past mismanagement resulting in accelerated erosion in the upper Apache Spring watershed. The practice of piling brush in drainages has caused substantial acceleration of erosion in the area. As water backs up behind the brush dams and subsequently cascades over the dams, the force of the water scours the stream bed creating headward erosion that migrates upstream forming deeper gullies (Colleen Filippone).

Another management practice that has increased erosion was the removal of mesquite above the spring. Areas have been left barren, and there has been no effort to re-establish vegetation on the slopes (Colleen Filippone). Some grasslands have been restored (Carrie Dennett, NPS CHIR), but these restored areas are located in the area of the relatively flat cemetery.

The slopes in need of re-vegetation are those immediately above the spring, just below the ruins. Intense rains accelerate soil loss on the slopes now that the mesquite has been removed. In the immediate area of the ruins, soil loss is occurring rapidly. Gullies by the flagpole area are moving upslope due to headward erosion. Soil loss could be mitigated by the judicious use of straw waddles and reseeded (Colleen Filippone). Ongoing erosion and rapid runoff will continue to affect the long-term viability of the spring until mitigation practices are established.

Issues involving mining, flooding, wetlands, or fossils are not present at Fort Bowie NHS. The shafts and adits from mining in the area have no geological reason to be located where they are (Todd Shipman). Mines at Fort Bowie are gated so that there are no safety or bat issues (Ron Kerbo, NPS GRD Cave Specialist; Alan Whalon, NPS CHIR-FOBO). The presence of iron bacteria poses a water quality problem at Fort Bowie NHS, but it is not considered significant (Colleen Filippone).

Recommendations

Recommendations from the scoping meeting include:

- Immediate attention to erosion and runoff issues. A site visit by an expert was recommended to evaluate this issue.
- Decrease soil loss in the immediate area of the fort by using straw waddles and reseeded.
- Remap 2 square miles (5 sq km) of the site in order to correct past mapping errors and to incorporate acreage that has been added to the park since the initial mapping.

Action Items

No action items were discussed at the meeting.

References

Bezy, John V. 2001. Rocks in the Chiricahua National Monument and the Fort Bowie National Historic Site. Arizona Geologic Survey, Down-to-Earth 11, 34-44, 48.

Table 2. Scoping Meeting Participants

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